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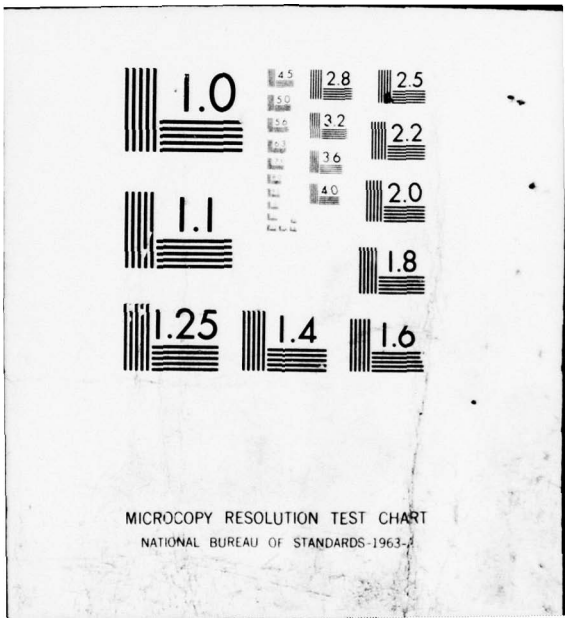
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Understanding and Appreciating Metaphors

Roger Tourangeau and Robert J. Sternberg

Department of Psychology
Yale University
New Haven, Connecticut 06520

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Three general positions have dominated thinking about metaphor. One view treats metaphor as a comparison--a view originating with Aristotle. The second view is that metaphor is an anomaly, the exact nature of the postulated anomaly differing with the theorist. The final view is somewhat vaguer than the first two; it sees metaphor as a conceptual interaction. We proposed a new version of the interaction position in which one domain or category of phenomena is somehow seen in terms of another. All the positions

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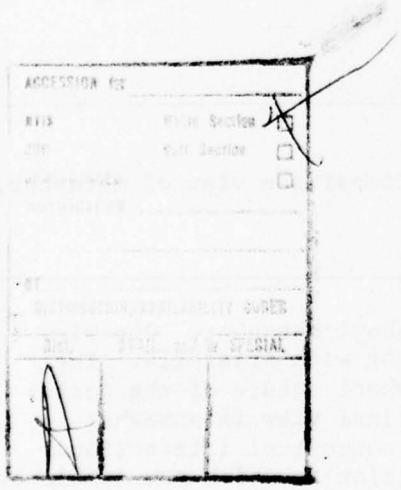
have implications for the question of what makes a good metaphor. On all three views, a central consideration in aptness is the similarity of the objects linked by the metaphor (the tenor and vehicle). In general, the anomaly position stresses the dissimilarity of tenor and vehicle, the comparison position the similarity, and the interaction position both. The exact nature of the quantitative relationship between similarity and aptness depends in part on how similarity is conceived. Psychologists have represented concepts as points in a semantic space, as bundles of features, or as "nodes" in a network of associations. Each way of representing concepts lends itself to particular measures of similarity or distance. The domains-interaction view we propose requires an elaborated notion of distance. What little evidence psychologists have gathered suggests that intermediate degrees of similarity make for the best metaphors. Besides bearing on the question of aptness, these general views on the nature of metaphor have implications for the process of interpreting metaphors. Anomaly theorists tend to argue that metaphors require special processes, different from those involved in literal sentences. Comparison and interaction theorists stress the continuity of metaphor and literal interpretive processes.



Understanding and Appreciating Metaphors

Roger Tourangeau

and

Robert J. Sternberg

Yale University

Running Head: Metaphor

Send proofs to Roger Tourangeau
Psychology Department
Connecticut College
New London, Connecticut 06320

Abstract

Three general positions have dominated thinking about metaphor. One view treats metaphor as a comparison—a view originating with Aristotle. The second view is that metaphor is an anomaly, the exact nature of the postulated anomaly differing with the theorist. The final view is somewhat vaguer than the first two; it sees metaphor as a conceptual interaction. We propose a new version of the interaction position in which one domain or category of phenomena is somehow seen in terms of another. All the positions have implications for the question of what makes a good metaphor. On all three views, a central consideration in aptness is the similarity of the objects linked by the metaphor (the tenor and vehicle). In general, the anomaly position stresses the dissimilarity of tenor and vehicle, the comparison position the similarity, and the interaction position both. The exact nature of the quantitative relationship between similarity and aptness depends in part on how similarity is conceived. Psychologists have represented concepts as points in a semantic space, as bundles of features, or as "nodes" in a network of associations. Each way of representing concepts lends itself to particular measures of similarity or distance. The domains-interaction view we propose requires an elaborated notion of distance. What little evidence psychologists have gathered suggests that intermediate degrees of similarity make for the best metaphors. Besides bearing on the question of aptness, these general views on the nature of metaphor have implications for the process of interpreting metaphors. Anomaly theorists tend to argue that metaphors require special processes, different from those involved in literal sentences. Comparison and interaction theorists stress the continuity of metaphor and literal interpretive processes.

Understanding and Appreciating Metaphors

Traditionally metaphor has been defined as an implicit comparison (Abrams, 1971). A comparison is involved because the relation between the two concepts linked in a metaphor is one of similarity. When the relation is not similarity, some other rhetorical figure results:

The White House urged settlement of the coal strike.

The relationship here between the White House and some spokesman for the President is contiguity instead of similarity, so that metonymy rather than metaphor is involved. The comparison in metaphor is implicit because ostensibly the metaphor does not compare two things but rather equates them ("Prudence is a wise old fool, courted by Incapacity") or substitutes one for the other ("sheathe thy impatience") or asserts a transformation ("Nerves reduced the speaker to a quivering mass"). Brooke-Rose (1958) gives a more complete list of the overt forms metaphor takes, none of which involves an explicit comparison. When an overt comparison is made, it is generally labelled a simile.

General Views of Metaphor

The Comparison View

Implicit in the traditional definition of metaphor is a theoretical stand on what a metaphor is and how it works. This theoretical stand, originating with Aristotle (1927; 1932), is the comparison view of metaphor. On this view, a metaphor is a comparison, in which one term (the subject or tenor of the comparison) is asserted to bear a partial resemblance (the ground of the comparison) to something else (the vehicle).

As with any comparison, there is some residual dissimilarity or disanalogy (the tension) between the terms compared in a metaphor, but comparison theorists tend to ignore the dissimilarity.

Blake's aphorism above, on this view, could be paraphrased: "The trait of prudence is like an old fool in that it is cautious, conservative, slow to act, dull, etc.". "Prudence" is the tenor or subject of the comparison; "wise old fool" is the vehicle or thing to which it is compared; caution, conservation, dullness form the ground or basis of the comparison. The only difference between a metaphor and simile is in overt form: similes include explicit comparative terms, while metaphors do not.

The comparison view is subject to a number of obvious difficulties, which it can handle only with some refinement. Metaphors and similes may be used in a variety of ways; they do not merely assert resemblances or make comparisons. Occasionally, for example, the metaphor or simile does something other than asserting a resemblance; it may even deny the resemblance--

(1) "O could I flow like thee [the Thames] and make thy stream
my great exemplar as it is my theme!
Though deep, yet clear; though gentle, not yet dull;
Strong without rage; without o'erflowing, full"

In Denham's apostrophe to the Thames (cited in Richards), the resemblance is only hoped for, not actual. (Shakespeare's sonnet 18--"Shall I compare thee to a summer's day"--similarly uses a resemblance, at the same time denying its accuracy.) The use of metaphor is, of course, no less varied than that of literal language and a full understanding of it cannot be divorced from consideration of the grammatical and pragmatic structures

in which the metaphor is embedded. These structures receive particular emphasis in efforts (e.g., that of Matthews, 1971; cf. also Mack, 1975) to combine the approach of generative grammar with the comparison view of metaphor. As Matthews shows, the comparison view must be augmented by a more general theory of language in order to understand metaphors in the diverse forms they take and in the many uses to which they are put.

That metaphors occur in many grammatical structures and are put to many uses is not a problem for the comparison view alone. All the main theories of metaphor, insofar as they are theories of metaphor and not general linguistic theories, face this difficulty. But one use of metaphor presents a particular difficulty for the comparison view. Sometimes metaphors are used to make assertions about unfamiliar tenors (cf. Ortony, Note 3, on "discovery metaphors"). Suppose someone asks, "Who is Ian Paisley?", and the reply is, "Paisley is the Ronald Reagan of Northern Irish politics". At least for the questioner, a direct comparison of Reagan and Paisley cannot be involved in understanding the metaphor, since the questioner doesn't know enough about Paisley to determine whether or how he is similar to Reagan. The "comparison" here probably entails transferring to Paisley all those characteristics of Reagan that Paisley may share. Some characteristics of Reagan can't possibly apply (that he is from California), because they contradict what little the questioner already knows about Paisley (that he is Irish). Defining the ground of metaphors with unfamiliar tenors is a problem, then, for the comparison view. One plausible way to handle this difficulty is to treat as part of the ground all that <u>might</u> be a similarity between tenor and vehicle, to treat as ground what can be transferred from vehicle to tenor rather than

what is already known to be shared.

The Anomaly View

The comparison view emphasizes, indeed takes as definitional, the similarity of the tenor and vehicle. Various theorists have taken the diametrically opposed position that what is characteristic of metaphor is the dissimilarity of the tenor and vehicle and the anomaly that results when the two are linked. The theorists taking this position differ on the exact nature of the anomaly involved. Walker Percy (1954) sees metaphor as a mistake, a misstatement which, by the very incongruity of what it yokes, gives to experience a peculiar distinctiveness and beauty. Beardsley (1962) considers metaphors to be partly self-contradictory; in his terms, they are "self-controverting". Wheelwright (1962) claims that one type of metaphor--"diaphor"--is nothing but incongruous juxtaposition.

The more common approach is to treat the anomaly involved in figurative language as a syntactic error, the violation of a "selection restriction." A selection restriction (Chomsky, 1965) is a rule that specifies which linguistic categories may enter into particular linguistic relations. A selection restriction on the class of verbs of feeling, for example, limits their use to subjects that are animate. "The tree was enraged by the remark" is anomalous because it violates this selection restriction. Since people can sometimes interpret (and parse) these anomalous sentences, generative linguists have sought to supplement their models in several ways. The basic idea is that anomalous sentences are interpreted by analogy to normal sentences. One approach here (Bickerton, 1969; Chomsky, 1964) is to propose procedures that suspend the violated selection restriction rules, allowing the remaining rules of the grammar to apply to the

anomalous sentence anyway. Another approach (Katz, 1964; Ziff, 1964) involves postulating additional rules that specify how to apply the normal rules of the grammar to these anomalous sentences.

Still another view of the nature of the anomaly or violation involved in metaphor treats the anomaly as semantic rather than syntactic. Metaphorical sentences are "sortally incorrect" (Guenther, 1975; Van Dijk, 1975; cf. Ryle, 1949, on "category mistakes"). Sortal incorrectness occurs when the argument of a predicate is of a type or "sort" inappropriate for that predicate. Predicates are restricted to particular ranges of application; when an object falls outside that range it cannot be used as a (sortally correct) argument for the predicate. Take "frightens" as an example. This is a predicate taking two arguments--a logical subject and object. The second argument is restricted to a particular range of the logical space--only things which are animate can be frightened. Selection of an argument outside this range ("John frightens sincerity") yields a sortally incorrect sentence. The sentence lacks a truth value, since sortal incorrectness involves a contradiction between the presupposition and the assertion of the sentence (Strawson, 1956). The "sortal incorrectness" position on anomaly, is, as may be apparent, the logical analogue of the "selection restriction" position of generative linguists.

The final view of the anomaly rejects these interpretations of the nature of the mistake. The anomaly, according to this final view, is neither syntactic nor semantic. Reddy (1969) provides a relevant example of a metaphor without anomaly. Imagine a rock in a geological display. We can say "The old rock is brittle with age" without either semantic or

syntactic anomaly. In another context, however, where the sentence refers to a geology professor, it becomes metaphorical. Sentences that can be interpreted either literally or metaphorically (depending on the context) present a difficulty for both the grammatical and semantic version of the anomaly viewpoint. Therefore, looser, "pragmatic" definitions of the anomaly have been proposed. The pragmatic view of the anomaly is that the metaphor, if interpreted literally, violates a pragmatic convention by introducing apparently irrelevant ideas. "The old rock..." referring to a professor, seems, taken literally, off the topic. Other violations may be involved (e.g., syntactic violations) but they needn't be. Even this pragmatic view has difficulties. Fables and parables are metaphorical (at least on some accounts) but introduce no extraneous, apparently out-of-context, elements. Thus, they do not meet even the weak pragmatic criterion that metaphors appear to be contextually anomalous.

The Interaction View

The comparison view emphasizes the similarity of the tenor and vehicle, the anomaly view, their dissimilarity. The interaction view (Black, 1962; Hesse, 1966; Miles, 1967; Richards, 1936; Wheelwright, 1962) attempts to emphasize as equally important the role of both similarity and dissimilarity in metaphor. This view is vaguer than the first two, in part because it is more a reaction against them than a positive theory in its own right. One criticism the interaction theorists bring to bear against the comparison view is that even the ground of a metaphor is typically nonliteral. To say "men are wolves" is, on the comparison view, to say that they are predators. The interaction theorist argues that people and wolves are not predators in the same way; there is only a rough resemblance between

predacity in people and in beasts. In general, the ground of a metaphor consists not of shared characteristics but of analogous ones. The position we espouse is a variant of the interaction view. We will call our view the domains-interaction position. We claim that in metaphor the domain of the vehicle and the characteristics applying within that domain are used as a template or model by which to organize the domain of the tenor. The process of seeing characteristics of the one domain as analogous to characteristics in the other can change our perception of both, although it affects primarily our view of the tenor. Seeing aggressiveness in people as an analogue to predation in wolves changes our perception of people and perhaps of wolves as well (the people probably seem worse than they did, the wolves better). One consequence of our view is that a metaphor often asserts a resemblance not only between two objects but also between two whole domains or classes of objects. Thus, Miles (1967) says that:

> What is vital...in metaphor is the sense of relative position within a group or class. If the dove is a cabbage, then the tanager is a carrot.

According to this view, a scientific model is a prime example of a metaphor. If we conceive of light as a wave, then we can also see specific visual phenomena as examples of refraction, diffraction, reflection, etc. As a result, not only does our understanding of light change, but our notion of a wave may broaden as well.

The anomaly, incongruity, or mistake emphasized by the metaphor-as-anomaly theorists reflects, according to the domains-interaction view, the distance between the domains of the vehicle and the tenor. Seeing the

phenomena of light in terms of the properties of waves is initially incongruous because the two domains seem so distinct. The metaphor aligns analogous phenomena within the two domains. Perhaps as a consequence of this alignment of objects within domains, the domains themselves may come to seem less dissimilar. But initially, at least, the similarity is between phenomena or objects from apparently dissimilar, even incongruously dissimilar, domains.

Similarity and Aptness

The three views distinguished so far differ in their emphasis. The comparison view emphasizes the similarity of the tenor and vehicle. The anomaly view emphasizes their differences. The interaction view, at least on our domains-interactionist version of it, emphasizes the dissimilarity of the domains from which the tenor and vehicle are drawn but the similarity of the properties or relative positions of tenor and vehicle within their respective domains. The different views also suggest different relationships between the aptness or quality of a metaphor and the similarity of the tenor and vehicle.

Monotone Hypotheses

On the view that metaphor is anomalous, we might predict two directly opposed relationships between similarity and aptness. Some theorists (Campbell, 1975; Percy, 1954; cf. Wheelwright, 1962, on diaphor) seem to favor incongruity; for them, the anomalous juxtaposition of diverse elements produces a fresh, distinctive view of experience. Since the dissimilarity of the tenor and vehicle contributes to this incongruity and its attendant novelty of vision, then the less the tenor and vehicle resemble each other, the better the metaphor. Breton (cited in Richards,

1936) states a similar view:

> To compare two objects, as remote from one another in character as possible, or by any other method to put them together in a sudden and striking fashion, this remains the highest task to which poetry can aspire.

For these theorists, then, what is important is novelty.

For others, however, what matters is clarity. The theorists who consider clarity important (Bickerton, 1968; Chomsky, 1964; Katz, 1964) tend to view anomaly as reducing comprehensibility: the worse the violation of the grammar, the harder to interpret the sentence. The less the tenor and vehicle resemble each other, the more serious the anomaly involved in their comparison. Extrapolating from this view, therefore, we expect that because clarity suffers as a function of the distance between tenor and vehicle, the best metaphors are those with the least distance. For the comparison theorist as well as this group of anomaly theorists, there is reason to predict that the metaphor improves as resemblance between tenor and vehicle increases. If, after all, a metaphor is a comparison, asserting a similarity, then the better the comparison (i.e., the more similar the things compared are), the better the metaphor. This hypothesis receives some support from a study (Malgady and Johnson, 1976) described below.

Nonmonotone Hypotheses

There is an obvious problem with the view that aptness increases with greater similarity. At some point a metaphor degenerates into a literal statement of resemblance or identity when the similarity of the tenor and vehicle of the metaphor becomes too great. To say that "A squirrel has a

chipmunk's face" is hardly to make a metaphor at all. If it is a metaphor, it's certainly not a very good one. With too close a fit, the metaphor becomes a bad metaphor or a nonmetaphor. We might, thus, predict that metaphors improve with increasing similarity until some cutoff or threshold is reached; when similarity exceeds this cutoff point the metaphor declines precipitously in quality.

The cutoff model may be difficult to distinguish empirically from another hypothetical relationship. Assuming that different subjects have different cutoffs (or that a single subject's cutoff varies over time), if we average across subjects, overall, we obtain a curvilinear, inverse-U shaped curve. Intermediate levels of similarity yield the best metaphors. Averaging across subjects with different cutoffs may not be the only way that a curvilinear function of this shape might result. Even Aristotle advises that "...metaphors [vehicles] should be drawn from objects that are related to the object in question [tenor] but not obviously related" (1932). The Poetics suggest two ways a metaphor can go awry: a metaphor can be dull or it can be obscure. If clarity increases with similarity, while interest or novelty decreases, these two opposed monotonic trends may combine to produce an inverse-U shape function (see Figure 1).

Insert Figure 1 about here

Hypotheses Involving Domains

The hypothetical functions above are based on a consideration of the anomaly and comparison views of metaphor. In their concepts of distance or similarity, these views do not distinguish the similarity of the domains

of the tenor and vehicle from the similarity of the positions of the tenor and vehicle within their domains. On the domains-interaction view, this distinction is crucial. For Miles (1967; quoted above), it is the degree to which tenor and vehicle occupy similar positions within their domains (which we will call the "fit" or within-domains distance between the tenor and vehicle) that matters in the ground of a metaphor, not the similarity of the domains. The various hypotheses outlined earlier (positive monotone, negative monotone, curvilinear, cutoff) can, of course, be reformulated with this distinction in mind but they do not require the distinction.

What prediction does our domains-interaction position make regarding the relation between distance and aptness? We propose several, related hypotheses that seem plausible given our point of view. We propose that metaphors are more apt as they compare objects drawn from more diverse domains and as the fit between tenor and vehicle gets better. Ideally, on this hypothesis, the tenor and vehicle should occupy exactly analogous positions within their domains (so that <u>within</u>-domains distance is maximal). Donne's conceits, with their elaborated points of comparison between diverse objects, are examples. In a famous conceit in his "Valediction: Forbidding Mourning," Donne, who is leaving his wife to go abroad, compares their souls to a compass:

(2) If they be two, they are two so
as stiff twin compasses are two;
Thy soul, the fixed foot, makes no show
to move, but doth if the other do.

And though it in the center sit,

yet when the other far doth roam,

it leans and hearkens after it,

and grows erect as it comes home.

A related hypothesis is similar in spirit to the one proposed above. It also says that aptness increases with the fit of tenor and vehicle (as within-domain distance decreases), but says that intermediate levels of distance between domains are best. When the distance between domains becomes too great, it may be difficult to see which conceptual objects occupy analogous positions within the two domains--and unless the corresponding conceptual objects can be aligned, the metaphor cannot be understood. To distinguish these two related positions, we will call the first the monotone domains hypothesis and the second the curvilinear domains hypothesis. These hypotheses are interactionist in at least two senses. First, a statistical interaction is involved, since the relationship between similarity and aptness depends on the type of similarity involved. Second, a conceptual interaction is involved as well--the distance between the domains guarantees that the tenor must be seen in a new way, in light of the vehicle. It is this conceptual interaction that gives the interaction view its name.

In summary, six hypotheses concerning the relation between similarity and aptness are considered. Two are simple monotone functions: on the positive monotone hypothesis, the metaphor gets better as similarity increases, or, on the negative monotone hypothesis, it gets worse. The curvilinear hypothesis combines these two monotonic trends into an overall inverted-U-shape function. The related cutoff model is a positive monotone

function with a cutoff point. We favor two hypotheses involving domains distance. The monotone domains hypothesis, like the curvilinear hypothesis, embodies two opposed monotonic trends: as distance between domains increases but distance within domains decreases (i.e., as "fit" increases) the metaphor gets better. The sixth hypothesis, the curvilinear domains hypothesis, suggests a limit on the monotone domains hypothesis—if distance between domains is too great, comprehension and aptness suffer.

Individual Differences

The hypotheses explored so far make no particular allowances for individual differences. All of them, of course, would reflect differences among people in the similarity of the two concepts involved. Beyond this source of individual difference, however, the hypotheses make no provision for variations among people. What differences might we predict and how might the various positions be augmented to account for them?

An obvious way that people differ is in literary sophistication. Some are very experienced readers of poetry and fiction; others have virtually no experience at all. Differences in literary sophistication probably affect the functions relating similarity and aptness. For the novice, understanding metaphors is difficult; novices have had little experience in dealing with complex metaphors. Therefore comprehension is hard for the novice, but finding novelty, easy. For the expert (e.g., a critic), comprehension is easier, but finding novelty in metaphor, more difficult. We expect, therefore, that factors leading to easy comprehension receive more weight from inexperienced readers; conversely, factors leading to novelty are likely to affect the critic more. Relative to the

novice, then, the critic prefers more obscure metaphors with lower levels of overall similarity; the novice prefers the more readily comprehensible metaphors with higher levels of similarity. Figure 2 shows how the positive monotone hypothesis represents these expected differences: the slope of the (linear) function relating aptness and similarity is partly determined by the degree of sophistication of the reader. In the cutoff model, a change in the cutoff point (critics having a lower threshold than novices) yields the predicted pattern as well: the critics like metaphors with little similarity more than the novice, but those with high similarity less than the novice (see Figure 3).

Insert Figures 2 and 3 here

Both the curvilinear hypothesis and the hypotheses involving distances between domains may be supplemented to reflect degrees of literary sophistication. As the reader values novelty and surprise more, the curvilinear hypothesis predicts that the function relating similarity to aptness should be displaced toward the dissimilarity end--the reader prefers metaphors with less similarity. Since the critics probably value novelty more than novices do, the curve for the critics shows this displacement toward greater dissimilarity--critics prefer less similarity. Since novices probably value comprehensibility more than the critics do, their curve should be displaced in the opposite direction, toward greater similarity. Figure 4 shows the resulting theoretical curves. The same arguments apply to the curvilinear domains hypothesis as well. Critics should prefer metaphors with greater distance between the domains of the tenor and vehicle; novices should prefer less distance between domains.

Insert Figure 4 about here

On the monotone domains hypothesis, aptness is a function of "fit" - the degree to which tenor and vehicle occupy analogous positions within their domains - and distance between domains. Assuming that these two factors are independent in their effects and that the monotone functions are both linear, we predict that

$$\text{Aptness} = A_o + b_1 \text{ (distance)} + b_2 \text{ (fit)}$$

The critic, we further predict, places more weight on distance (as does Breton, above) than the novice does--b_1 for the critic will be greater than b_1 for the novice. Thus, each of the models offers some account for the expected individual differences.

Evidence on These Hypotheses

Psychologists have done little work bearing on these hypotheses (see Billow, 1977; or Ortony, Reynolds, and Arter, Note 5, for recent reviews, Henle's 1962 survey is an excellent early review). Two studies report evidence on the relation of similarity and aptness. Kraut (Note 1) reports a study assessing the effects of the "incompatibility" of adjective-noun pairs on ratings of their poetic quality. He gave subjects pairs, such as "mechanical bouquet". If we assume (as does Kraut) that subjects interpret the pairs metaphorically, then it seems plausible that incompatibility of the adjective and noun is directly related to distance between the vehicle of the metaphor (the noun given) and whatever tenor the subject infers for the pair. The results are ambiguous. Kraut used two sets of adjective-noun pairs. In one set, Kraut observes a curvilinear, inverse-U shape function (i.e., a marginally

significant quadratic trend) relating distance and quality. In the other set, however, no such trend is evident. Malgady and Johnson (1976) report a similar study. They presented subjects with metaphorical sentences of the form "The adjective$_1$ noun$_1$ is an adjective$_2$ noun$_2$ (e.g., "the sleek hair is shiny silk"). By adding features to the noun concepts, the adjectives, according to Malgady and Johnson, alter the similarity of the nouns. The two nouns varied in their initial degree of similarity; the two adjectives varied in their effect on the final similarity of the nouns. The relationship between similarity and goodness depended, in part, on the initial degree of similarity between the nouns. For noun pairs low in similarity initially, the resulting similarity (as affected by the adjectives) correlated highly ($r = .87$) with goodness; for noun pairs initially high in similarity, on the other hand, resulting similarity was considerably less related to goodness ($r = .42$). The presence of significant positive correlations in both conditions may argue for the monotone positive hypothesis. The difference in the two correlations, however, may reflect an overall inverse-U shape curvilinear trend. At low overall levels of similarity, the inverse-U shape function is well approximated by a positive linear model. As similarity increases, however, the U-shape function is less closely fit by the linear model. (And at very high levels, of course, we expect a negative relationship, given an overall inverse-U shape function.) So, like Kraut's, Malgady and Johnson's findings are ambiguous. Since neither of these studies look at the distance within or between domains, it is hard to evaluate their implications for the two hypotheses (monotone domains and curvilinear domains) involving those variables. The negative monotone function, however, receives no support in either study.

Conceptions of Distance

The discussion of the various possible relations between similarity and aptness has not so far included an attempt to characterize the concept of psychological distance.

Can the various hypotheses relating similarity and aptness be formulated rigorously? Are the viewpoints underlying the hypotheses compatible with the main psychological models of distance? We will argue here that the various positions are, in fact, compatible with psychological treatments of distance, the domains-interaction viewpoint requiring a somewhat elaborated treatment of distance.

Psychologists have employed various conceptions of distance, each based on some notion of the meaning of a concept. Sometimes concepts are seen as sets of values on relevant dimensions of meaning, such as the connotative dimensions of Osgood, Suci, and Tannenbaum (1957). A natural way to treat distance, given this view of meaning, is the Euclidean conception; the psychological dimensions are analogous to spatial ones, psychological distance to spatial distance. Another way to look at concepts is to see them as bundles of elementary "atoms" or features of meaning. This view is popular among generative linguists (see Katz and Postal, 1965), where the "atoms" are semantic markers. Recently, Tversky (1977) has developed a way to measure the similarity of concepts when concepts are treated as bundles of features. Still another way of looking at concepts is popular among workers in artificial intelligence. Their approach (see for example, Anderson, 1976; Quillan, 1969; Schank, 1975) is to treat a conceptual system as an associative network. Concepts are "nodes" or points of intersection in the network; the links connecting the nodes are elementary semantic relations. Wickelgren's recent

(1976) discussion of the strength of a "chain" of links between nodes (and other conceptions of chain distance, such as Johnson's, 1967), provide ways of conceiving of the distance between elements in a network. A final approach, particularly consonant with the domains hypotheses above, treats concepts as falling into basic categories or clusters. This approach requires a more elaborate conception of distance. Besides offering a method of representing the general meaning of a term, each of the approaches can represent how context can modulate this general meaning. By affecting meaning and similarity, context also can affect the aptness of metaphors.

Euclidean Distance

The treatment of conceptual distance as distance in a Euclidean space was one of the earliest approaches to be used by psychologists. As early as 1957, Osgood et al. had done cross-cultural factor analytic studies that represented a number of concepts as points in a three-dimensional affective space. The dimensions themselves -- evaluation, potency, and activity -- proved robust across a number of cultures and content domains. Later nonmetric techniques (Shepard, 1962 a,b; Kruskal, 1964 a,b) shared with factor analysis the goal of using a small number of dimensions to represent the relevant concepts, but made less stringent assumptions about the nature of the data involved.

In a Euclidean space, the distance between two points is a function of the difference between them on the relevant dimensions:

$$d(A,B) = \left[\sum_{i=1}^{m} (a_i - b_i)^2\right]^{1/2} \qquad (1)$$

Here a_i and b_i are the coordinates of A and B, the two concepts, on the i^{th} dimension of meaning, and m is the number of dimensions.

How might context affect the position of a concept in Euclidean space? One way is that adjectives or other predicates added by the context to a "token" or instance of the concept may alter the location of the concept on one or more psychological dimensions (may change the value of its coordinates). The adjectives in the Malgady and Johnson study, then, act as vectors added to the nouns, altering their positions in the semantic space. A second way that context alters distance is to increase or decrease the salience of a particular dimension. After a discussion of the aggressiveness of nations, for example, Osgood, Suci, and Tannenbaum's potency dimension may be particularly salient. These differences in salience can be represented by including weights in the Euclidean distance formula:

$$d_k(A,B) = \left[\sum_{i=1}^{m} W_{ik}(a_i - b_i)^2\right]^{1/2} \qquad (2)$$

Here W_{ik} is the relative weight attached to dimension i within a particular context (k).

Distance in a Feature Space

The Euclidean approach to conceptual similarity is less tractable when there are many dimensions of variability that distinguish the concepts. The feature approach does not suffer from this limitation. Tversky (1977) suggests measuring the distance between concepts, when concepts are treated as bundles of features, as a weighted sum—

$$d(A,B) = b_1 f(a - b) + b_2 f(b - a) - b_3(a \cap b) \qquad (3)$$

of some (monotonic, increasing) function (f) of the number of features unique to concept A (i.e., a-b), those unique to B (b-a), less those they have in common ($a \cap b$).

Context affects the apparent distance between two concepts in three ways. First, by increasing the salience or prominence of one concept relative to the other, the context can alter the weights (b_1 and b_2) attached to the features distinctive to one concept or the other. In a metaphor, Tversky argues, the features of the tenor are more prominent than those of the vehicle. Second, a context can predicate additional features of instances of A or B , and so change the set of features associated with the concepts. The values of f(a-b), f(b-a), or f(a∩b), would change as well. Finally, the context may increase the salience or importance of some features at the expense of others. If f is a simple additive function of the weights attached to the features, then

$$d(A,B) = b_1 \sum x_i + b_2 \sum y_j - b_3 \sum z_k. \qquad (4)$$

In this equation, x_i is the weight attached to a feature unique to A; y_j is the weight attached to a feature unique to B; and z_k is the weight attached to a shared feature. These values vary, depending on the salience of the feature within a context.

Distance in an Associative Network

Tversky's metric formalizes the notion of conceptual distance, when concepts are seen as bundles of features—a view of the meaning of concepts supported by generative linguists (such as Katz and Postal, 1965). In the Chomskyan tradition, the dictionary entry corresponding to the sense of a word includes features of two types: a series of semantic markers, followed by a distinguisher. The markers are general elements of meaning that enter into the definitions of many words; in contrast, the distinguishers are particular, applying only to a single word sense; they serve to distinguish that word sense from closely related ones. More recent developments in theoretical linguistics

(e.g., Fillmore, 1968) have tended to focus less on the internal structure of concepts and more on their interrelations. The most elaborate development of this trend has been among theorists using computer simulation models of language processes (e.g., Anderson, 1976; Lindsay and Norman, 1977; Quillian, 1969; Schank, 1975). For these theorists, concepts are embedded in an associative semantic network. There are several types of link or relation among concepts. Initially, these links had a decidedly syntactic flavor; later network theorists tend to emphasize the abstract conceptual character of the interconnections. A typical link in these theories is the subset-superset link. Many of these theorists assume that an important process acting upon the associative network is "activation"--tracing out the connections among the concepts in the process of remembering (see, e.g., Collins and Loftus, 1975; Collins and Quillian, 1972). The spread of activation is usually seen as a parallel process in which several links may be simultaneously activated. These theorists often further assume that our memory system is sensitive to "intersections" in the activation process: When one path being traced (having become activated) converges on a node to which another path has led, we can take note of the intersection.

The concept of intersecting paths serves as a basis for extending Tversky's feature metric to concepts in an associative network. In a network, a feature shared by two concepts might be defined as a node connected by paths leading from both. Since in such a network, everything is connected, however indirectly, to everything else, this simple extension of Tversky's notion will not do--by this proposed definition, everything shares features with everything else. Moreover, only concepts with the same relation to another concept, should be said to share a feature. Therefore, a reasonable additional condition for a shared feature is that the two paths leading to the node of intersection

contain the same types of links and that these are in the same order; the paths should be identical, that is, except that they originate in the two different concepts. Links from the concepts that don't lead to an intersecting node (subject to the condition above) are distinctive to that concept. Some paths of intersection (some relations to other concepts) are so complex that the connection is unlikely to be salient. Indeed, most network theorists assume that the "length" of a path determines whether that path is activated; when the path is too long--the connection too weak--activation will not spread and intersection will not occur. Thus, we define two concepts as sharing a feature when both bear the same relation (have identical connecting paths) to some other concept (a node of intersection), provided that the relation is simple enough (the path is short enough for activation to spread along the path and for intersection to occur).

Having defined a shared feature in a network, we can extend Tversky's concept of distance to nodes in a network. Another possible view is that distance is a direct function of the length of the paths (i.e., strength of the connection) between two concepts. This "length", or strength of connection, depends on a number of factors -- how many links are in the path, how strong each one is, how many alternate routes connect the concepts.

Wickelgren (1976) suggests a number of measures of overall strength. Consider first the strength of a series of links. The strength of this "chain" might be defined as the minimum of strength of the links; the chain is then, as strong as its weakest link (cf. "chain distance" in Johnson, 1967). Or the strength of the chain might be the geometric or harmonic mean of the strength of the links; although these two rules may not seem particularly intuitive, the harmonic mean rule has a physical embodiment--electrical conductancies in

a series circuit combine according to this rule. If strength reflects the probability of traversing a link, then a multiplicative rule makes sense. Often several paths connect the two concepts. Consider, then, the overall strength of several "parallel" chains. Wickelgren suggests an additive rule for combining the strengths of several paths linking two concepts. We might also consider a maximum rule (cf. Johnson, 1967); the distance between two points would be the strongest (i.e., the shortest) path between them. In short, a number of metrics for the strength of relation between two concepts make some sense, depending in part on how we conceive of "strength" of a path in a network. For each of these conceptions of strength of connection in a network we can define a corresponding measure of distance.

Distance in a Domains Theory

The idea that concepts fall into a set of basic clusters or "natural categories" (Rosch, 1973 a,b) has emerged recently in the psychological literature, partly as a reaction against dimensional and associative treatments of conceptual distance (cf. Rips, Shoben, and Smith, 1973). Concomitantly, a variety of mathematical techniques have been developed for representing the similarity relations among concepts by "clustering" (Everitt, 1974; Johnson, 1967; Shepard and Arabie, Note 8). Holman (1972) argues that hierarchical clustering and Euclidean distance are fundamentally incompatible ways of treating distance, but other, nonhierarchical clustering, schemes are clearly consonant with a Euclidean space. The psychological theorists usually define the clusters in terms of a protypical instance and more peripheral instances. Similarly, some clustering algorithms define a cluster as including a "centroid" (mean of points in the cluster) and the points "closer" to that point than to any other centroid. (Occasionally, the psychological and statistical notions of a prototype

may overlap, as in the work of Posner and Keele, 1968). As Tversky (1977) notes, there are affinities between some cluster and feature notions of distance (one reasonable definition of a cluster being all the points sharing some feature or set of features).

If we let domains correspond to clusters, then the various clustering algorithms provide definitions of distance between objects and between clusters. Tempting as it is to treat domains as clusters, this approach can lead to difficulties. With hierarchical clusters, for example, the distances between a point in one cluster and all the points in another cluster are identical. (In a tree diagram, for example, all the items within one class are the same distance from those in another class.) The concept of two points in different clusters (domains) occupying analogous positions within those clusters is difficult to reconcile with this homogeneity of distances between objects in different clusters.

Although this hierarchical clustering approach to distance is difficult to apply to domains distances, concepts of distance based on features or dimensions can be applied to domains. According to the domains view, some features or dimensions apply within domains and some higher-order dimensions or features apply to the domains themselves. The idea of a hierarchy of dimensions here is similar to that involved in some theories of abilities: There are first-order ability factors, then second-order factors based on correlations among first-order factors, etc. There is a conceptual hyperspace representing the distances between the several domains; and lower-order spaces representing the positions of objects within a domain. Besides entailing the notion of a hierarchy of distances, the domains hypotheses stated earlier require that at least some of the lower-order dimensions or features applying within a domain have analogues

in other domains. One simple way of meeting the requirement that within-domain dimensions or features have analogues in other domains is for the conceptual space to include some dimensions that "crosscut", or apply equally well to, several domains. Often, however, dimensions applying within a domain are taken with reference to the objects within that domain. Size, for example, would seem to be a dimension equally relevant to a number of domains. Yet some size terms, as they apply to people, do not have the same scale as they apply to other things. To say that "Bill Walton is large" doesn't imply anything about his size relative to a mountain or to a fish. Size is a dimension taken with reference to the members of particular domains. Garner's (1974) notion of an inferred set is similar to the notion of a domain here: Simple geometric figures, according to Garner, belong to "inferred sets" of closely related figures. The dimensions which characterize a figure depend in part on the inferred set of the figure; often the dimensions operate only with reference to that set.

It is now possible to give a more explicit description of the concepts of distance between domains and the "fit" of concepts in different domains. If we view the domains as points in a higher-order conceptual space of domains, then the distance between two domains can be treated as the Euclidean distance between the points. Equation (1) applies directly:

$$d(A,B) = \left[\sum_{i=1}^{m} (a_i - b_i)^2 \right]^{1/2} \qquad (1a)$$

A and B now represent domains, a_i and b_i the coordinates of the domains on the m dimensions of the higher-order space of domains. We can apply the Euclidean concept of distance not only to the distance <u>between</u> domains, but also to the <u>within</u>-domain distance between two things in different domains. The within-domain distance is a function of the difference between positions of the two concepts on the corresponding dimensions within their respective within-domain

spaces:

$$d(A,B) = \left[\sum_{i=1}^{m} (a_i - b_i)^2\right]^{1/2} \qquad (1b)$$

A and B now refer to concepts within different domains; a_i and b_i are the coordinates of these concepts on the m corresponding dimensions within the two within-domain spaces. The "fit" is simply the opposite of within-domain distance.

Tversky's feature metric affords a similar redefinition. In Tversky's model distance between concepts is a function of features unique to one or the other concept, less those they share (see equation 3). Some features apply to concepts within a domain; others apply to the domains themselves. Distance between domains is determined by those that apply to the domains:

$$d(A,B) = b_i\, f(a-b) + b_2\, f(b-a) - b_3\, f(a \cap b). \qquad (3a)$$

A and B are two domains; the distance between them is an additive function of the number applying only to (a-b)A, the number applying only to (b-a)B and the number they share ($b \cap a$). Similarly, we can define the within-domain distance of concepts within different domains as a function based on the corresponding features applying within the two domains

$$d(A,B) = b_i\, f(a-b) + b_2\, f(b-a) - b_3\, f\,(a \cap b) \qquad (3b)$$

A and B are concepts in different domains; the number of corresponding features they share ($a \cap b$), the number unique to A (a-b), and the number unique to B (b-a) determine their distance.

The concepts of domains distance and fit can also be defined for network distance. Domains correspond to the higher-order (or superset) nodes that most network theorists postulate. Corresponding or analogous features can be treated as analogous paths in the network. One path corresponds to another path when both consist of the same types of link in the same order. If the path leading

from concept a consists of a link of type 2 followed by a link of type 1, followed by a link of type 3, the analogous path leading from concept b should also consist of a type 2 link, followed by a type 1, followed by a type 3. Russell (Note 7) uses a similar definition of analogous structures in a semantic network; she applies that definition in describing the process of interpreting metaphorical phrases.

Sources of Asymmetry in Distances

As Tversky (1977) has noted, distance need not be a symmetrical relation. The main source of assymmetry involves the relative "prominence" or salience of the two concepts involved. In metaphors, Tversky argues, the tenor is generally more prominent than the vehicle. His feature metric allows different weights (b_1 and b_2 in equations 3 and 4) for the features distinctive of the tenor and those distinctive of the vehicle. If the two concepts were reversed in role and, thus, in their prominence, then the weights ensure a different sum (that is, a different overall distance). Besides reflecting differences in the overall salience of a concept, asymmetry may reflect differences in the salience of a dimension or feature. These differences are reflected in the weights (x,y, and z) of equation 4. In a dimensional model, the salience of a dimension within a domain is measured by the variance it accounts for. Asymmetries in distance may reflect asymmetries in the prominence of the dimension: within one domain, a dimension may be highly salient, being the main basis for distinguishing the members of that domain; within another domain the corresponding dimension may be trivial. The impact of this dimension on the overall "fit" between the concepts depends on whether the dimension is salient within the domain of the tenor or that of the vehicle. (Ortony, Note 3, as noted below, suggests that similar symmetries in the salience of particular features are crucial in metaphor.)

Besides defining salience of a dimension within a domain, we can define salience of a dimension for a particular concept: the relative extremity of the concept on that dimension defines the salience of the dimension for that concept. Again, the degree that distance on the dimension affects overall distance between the tenor and vehicle may depend on whether the dimension is more salient for tenor or vehicle. Since the salience for the two concepts may differ, asymmetries may result: the distance between A and B when A is compared to B (and since A is the subject or tenor, it is more prominent than B) differs from the distance between A and B when B is compared to A. Not only do concepts differ in particular domains or roles, but some are intrinsically more prominent and more interesting than others: we use farm animals (pig, cow, chicken, horse, bull, lamb, etc.) as vehicles for types of people, but not the reverse; states of the weather are images of psychological states in the "pathetic fallacy" but psychological states do not connote the weather. This intrinsic interest of the concept or domain is still another source of differences in salience and hence is another source of asymmetry.

Comprehension Processes

We have described three general views on metaphor and traced their implications for the question of how similarity relates to aptness; we then examined the main ways to view similarity itself, noting that they do not require strict symmetry. The anomaly, comparison, and domains-interaction views also have implications for the question of how metaphors are interpreted. The most obvious of these consequences is, perhaps, the implication of the metaphor-as-anomaly position that some special process must be involved in understanding metaphors (and other figurative language) beyond what is required by ordinary (nonanomalous) sentences.

Special Processes: the Anomaly View

In their discussion of "semi-grammatical" sentences, Chomsky (1964) and Katz (1964) consider sentences that violate grammatical rules (especially selection restrictions), but remain interpretable nonetheless. How is the grammar to deal with such sentences? One tack (as noted earlier) is to suspend the violated rule and let the remaining rules of the grammar produce a (partial) description of the structure of the sentence. This is the approach Chomsky takes. Another tack is also possible: Instead of subtracting rules from the grammar, Katz suggests adding rules that augment the grammar's ability to deal with such sentences. With the aid of these special "transfer" rules, the normal rules of the grammar apply to anomalous sentences despite the anomaly. A model of the processes might take this form: (a) the grammar tags a sentence as anomalous; (b) owing to the nature of the anomaly, either special rules are applied or some rules are suspended, and a structural description is assigned to the sentence; (c) this structural description serves as the input to the interpretive component, which produces as normal a reading as is possible, given that the structural description with which it begins is incomplete. Clearly step (b) where special rules are invoked or regular rules suspended would be an addition to the process involved in interpreting "normal" sentences.

When rules are suspended, an additional special process is invoked that "fixes" the violation. According to both Chomsky (1964) and Van Dijk (1975), this additional process involves finding a higher level category to which the vehicle belongs that does not violate the selection restriction rule (or, in Van Dijk's terms, is not "sortally incorrect"). In "John frightens sincerity", "frightens" is not only a verb of feeling (violating a selection restriction or sortally incorrect with "sincerity"), it is also a member of the class of actions with direct objects (i.e., a transitive verb). At this more abstract

level, no violation is involved.

Comparison Views of the Interpretive Process

The process of tracing up the hierarchy of syntactic (or semantic) categories is similar to some views of comparison processes. In these views, the objects compared (the tenor and vehicle) share some features. Of course, all the terms sharing some of the same features can be seen as forming a class. Finding a higher-level category shared by tenor and vehicle, then, is equivalent to finding their common features. Aristotle's taxonomy of metaphor makes it clear that he thought of finding a category to which both tenor and vehicle belong as one method to determine the ground of a metaphor. (For related positions, see Basso, 1976, and Thibadeau, Note 12).

Other linguistic theorists take the comparison rather than the anomaly position on metaphor. For these theorists, underlying the surface form of the metaphor is a deep structure containing a simile (Mack, 1975; Miller, Note 11) or an explicit (though nonliteral) statement of identity (Matthews, 1971). On this view, the special process involved in metaphor is somewhat more continuous with normal processes. Metaphors require only a more complicated transformational derivation than similes and other statements of comparison or identity. Perhaps similes ought to be more quickly and easily understood than metaphors, if only because their deep and surface structures are more closely related to each other than are those of metaphors. But that this more complex derivational history affects performance is a moot point: the psychological status of entities such as deep structures and transformation rules is unclear at best (Fodor, Bever, and Garrett, 1974).

Most comparison theorists, of course, focus on comparison as the special process involved in metaphor. This process is usually cast in terms of features:

the features of the tenor are compared with those of the vehicle; the shared features form the ground of the metaphor (see, e.g., Guenther, 1975; Malgady and Johnson, 1976; Matthews, 1971; Tversky, 1977; Ortony, Note 3). As Ortony and others have noted, sometimes the process cannot consist of selecting shared features, but consists instead of rejecting those features that are not shared by both tenor and vehicle, and transferring to the tenor all the other features of the vehicle. When the tenor is unfamiliar, presumably all the features of the vehicle that may be applicable are transferred to the tenor. Sometimes the further assumption is made that only some of the potentially applicable features of the vehicle are transferred to the tenor--for example, only those that are especially prominent (Bickerton, 1969; Guenther, 1975; Van Dijk, 1975) or somehow particularly transferable.

Domains-Interactionist Views of the Interpretive Process

Assuming that a comparison process is central to understanding metaphors, we might ask how this process is special, how it differs from the process involved in understanding "normal," literal comparisons. The most obvious answer to this question is that in metaphors the overall degree of similarity is considerably less than in literal comparisons. Interaction theorists, however, tend to give more complex answers to this question. While they agree in part that comparison may be involved, they tend to view the comparison as more restricted in metaphor then in literal comparisons. Ortony (Note 3), for example, suggests that in literal comparisons the objects compared share features that are salient of both objects; in nonliteral comparisons, on the other hand, features of the tenor (or subject of the comparison) that are low in salience match features of the vehicle that are highly salient. Since the features that are shared are emphasized by the comparison, we often see the tenor in a new light; the nonliteral comparison makes prominent features that are

normally not salient, and suppresses those (nonmatching) features that normally are salient. Ortony (Note 3) presents some evidence that, for literal comparisons, a higher proportion of the most salient features are shared by the two objects compared than for nonliteral comparisons (which share almost no salient features).

On our view, the domain-related features of both tenor and vehicle are suppressed in a metaphor, since only the within-domains features or dimensions form the basis of the comparison: in "comparing" a compass to parted lovers, Donne stresses certain points of resemblance, but the points of resemblance do not involve the category membership of either the lovers or the compass.

Black (1962) originally proposed that metaphors emphasize some features of the tenor (those shared with the vehicle) and suppresses the others. For Black, however, the features relevant to metaphors are of a special sort: they are not denotative features, defining the concept involved, but are "associated commonplaces", nondefinitional "knowledge" about the concept including connotative beliefs. These nondefinitional beliefs are what is transferred from vehicle to tenor. Black's view, of course, overlaps with Ortony's. Presumably, the relevant commonplaces associated with the vehicle of a metaphor are likely to be salient ones. Both these views are similar to the domains-interactionist position we argue. However we characterize the features that are temporarily deemphasized, the view shared by various domains-interaction theorists -- that they are suppressed-is similar to the suggestion of anomaly theorists -- that the features of the vehicle involved in the anomaly are temporarily suspended so that the violation is overcome. The offending features are ignored; only higher-level categories and the features relevant to them are retained in the interpretive process.

On the domains-interactionist view we propose, nonliteral comparisons

differ from literal ones in that they compare objects drawn from different domains. Literal statements of resemblance, in contrast, typically compare objects from a single domain. The basic difference between interpreting literal and nonliteral comparisons is in the necessity to align the corresponding features or dimensions in interpreting nonliteral comparisons. Comparing two things from different domains, we argue, involves assessing the "fit" between them; assessing the fit depends in turn on aligning the two domains from which the objects are drawn. Comparison is, on our view, the last stage of a multi-stage process.

Our view of the nature of these stages grows in part out of earlier work by Sternberg (1977a, 1977b) and Rumelhart and Abrahamson (1973) on analogies. (Nigro and Sternberg, Note 2, and Sternberg, Tourangeau, and Nigro, in press discuss the extension to metaphor of Sternberg's earlier work on analogies in more detail.) In Sternberg's and Rumelhart and Abrahamson's earlier work, subjects get three terms of the analogy and must select the fourth:

Pig:Sheep :: Goat:

(1) Monkey

(2) Cow

According to Sternberg's model, three steps are of special importance in this task. The subject <u>infers</u> the relation between pig and sheep, then <u>maps</u> the relation between pig and goat, and finally <u>applies</u> the inferred relation between pig and sheep to goat. The application leads the subject to an "ideal concept" (the concept standing in the exact relation to goat as was inferred to hold between pig and sheep). The response chosen from a set of alternatives depends on the similarity of the choices to this ideal point (the most similar being the most likely to be chosen). In a multidimensional semantic

space, the three operations can be represented as first constructing a vector from the first term to the second (i.e., inferring their relationship), moving from the first to the third term (i.e., mapping the relation between them), and finally, constructing a vector from this third term, exactly parallel to that linking the first and second terms (application). This second vector terminates at the ideal point for the solution. Formally, this model of the process of comprehending analogies is similar to the outcome model proposed by Rumelhart and Abrahamson (1973); they too use the concept of an ideal point as guiding response selection in analogy problems. Rumelhart and Abrahamson, however, do not make explicit their assumptions about the processes subjects use in comprehension.

How do these models relate to metaphor? According to the domains-interactionist view we are arguing, the "location" or features of the tenor and vehicle are taken with reference to their respective domains. The position of the vehicle in the semantic space of its domain can thus be seen as a vector from the origin of that domain. The origin reflects either a prototypical instance (Rosch, 1973) or a more statistical prototype (Posner and Keele, 1968). Constructing (or retrieving) this vector is analogous to Sternberg's inference operation. Next, the semantic space of the tenor's domain must be brought into congruence with that of the vehicle. The dimensions within the vehicle's domain serve as a kind of template for those within the domain of the tenor; its dimensions are aligned (as much as possible) with the corresponding dimensions within the domain of the vehicle. This alignment or rotation process, as we noted earlier, becomes more difficult as the two domains involved become more dissimilar.

What guides or limits the alignment or, to use Sternberg's terms, "mapping"

operation? Several possible sources of correspondence may determine how one domain is "realigned" to fit another. First, two dimensions may be linked by a correlation in our experience. Part of the basis for synaesthetic correspondences (across sense modalities) may be such experienced correlations: the correspondence between "warmth" in hues and temperature, for example, may reflect their frequent co-occurrence. Second, the dimensions may map into a common scale or dimension. Height in people and in mountains may be relative to other people and mountains, but there is a common "absolute" scale of height. Similarly, a feature or structure in one domain and its analogues in other domains may all share a common feature at a higher level of abstraction. (Russell, Note 7, discussed below, takes this approach.) Thus, predacity in both people and wolves may partake of some very abstract feature of destructiveness. Finally, even a common label may suggest a correspondence between two dimensions within different domains. Presumably, the alignment is directed primarily at bringing features or dimensions in the domain of the tenor into congruence with the most salient features or dimensions within the domain of the vehicle.

Whatever the exact basis for the superimposition, once the two spaces have been superimposed or brought into alignment in this way, we can then construct a vector from the origin to an ideal point in the space representing the domain of the tenor - a vector identical in length and parallel to that relating the vehicle to the origin of its domain. Constructing this vector is the analogue of Sternberg's application operation. This ideal point is useful in accounting for three processes relevant to interpreting metaphors. First, if the tenor is not explicitly given by the metaphor (as is often the case), then the intended tenor is some concept close to this ideal point. The ideal point thus guides selection of tenors not explicitly mentioned. Second, if the tenor is given, but is unfamiliar to the listener so that its location

within its domain is unknown, then the ideal point represents that location. Finally, when the tenor is both given and familiar, then its distance from the ideal point is the "fit" of the two concepts. Judging the fit, we have argued, is one component in determining the aptness of the metaphor. If the fit is bad enough, then a second "mapping" of the tenor's domain into the vehicle's may be attempted.

Sternberg's (1977a, 1977b) inference, application, and mapping operations are compatible with nondimensional representations of meaning as well as dimensional ones. Similarly, the processes envisioned here for comprehending metaphors are applicable given either feature or network models of meaning. On the domains-interaction view we argue, the relevant features of the vehicle are those it does not share with all members of its domain (features that all members share would, we assume, be relevant at the next level of representation, applying to domains rather than to objects within a domain). In interpreting a metaphor, these distinguishing features of the vehicle are found (inference). Next, the features within the domain of the tenor are aligned with the corresponding features within the domain of the vehicle (mapping). In discussing analogies in science, Hesse (1962) gives an example of aligned or "mapped" features from different domains:

Birds	Fish
wings	fins
feathers	scales
lungs	gills
etc.	etc.

After the alignment has taken place, an ideal concept is found, consisting of the set of those features within the domain of the tenor that correspond to the features of the vehicle (application).

Russell (Note 7) has discussed metaphor within the framework of Schank's (1975) theory of language. Schank's theory is, in our terms, a network theory and the processes Russell postulates seem to us the network equivalent of the processes described above. Russell assumes that there are several systems of concepts, features, and action. She calls these systems "levels" (rather than domains) and, although they are more general than our domains, they serve a similar role in her theory. She assumes, as we do, for example, that acts on the "mental" level may have effects analogous to those of acts on the "physical" level. Metaphors, Russell argues, are based on abstract structural similarities between concepts on different levels. Take one of her examples: "he chewed on the thought." Literally, "chewed" is an action on the physical level. Part of its structure is that the "chewer" incorporates what's chewed into himself. This part of the structure has an analogue on the mental level (the level that the object--"thought"-- calls for here); "thoughts" are also incorporated into the thinker. Interpretation, in our terms, consists of finding the structures (paths in the semantic network) in which the vehicle is embedded (inference), finding the corresponding links or relations between concepts at the level or domain of the tenor (mapping), and then constructing an analogous structure or path in the domain of the tenor (application). The paths constructed in this way, based on the corresponding relations between concepts in the domain of the tenor, function as a kind of ideal point. To return to Russell's example, having inferred the relevant path involving the vehicle, "chewing", we apply it in the domain of mental acts; "the actor does something which results in the incorporation of the thought", or its network equivalent is this result. This structure places severe constraints on the tenor--the actual (mental) action

that is intended. Of course, if we already know the tenor, then the "fit" of this structure to the actual structure involved can be assessed.

On our view, then, the "comparison" phase in the interpretation of metaphor actually involves several stages: placing the vehicle relative to its domain (inference); using the features, dimensions, or links within the domain of the vehicle as a template against which those within the domain of the tenor are matched (mapping); finding the ideal point in the reorganized domain of the tenor, the concept that occupies the position in the domain of the tenor exactly analogous to the position of the vehicle (application). Comparison (in our terms, assessing fit) consists of measuring the distance between the ideal concept and the actual tenor (when it is given). This view assumes that features, relations, or dimensional values characterizing domains (rather than objects within domains) affect the ease with which the mapping operation is performed, but are not salient in interpreting the metaphor. (They are, as Black or Ortony might argue, deemphasized.) Further, those features, relations, or dimensions within one domain that have no analogue in the other domain are also deemphasized by the metaphor.

Other Views on Comprehension Processes

Anomaly theorists focus on the process of recognizing that a metaphor and its attendant violation has occurred, and they emphasize the discontinuity of the processes of interpreting metaphors and literal sentences. The processes assumed by these models center on the violation, or, to use a traditional term, the tension of the metaphor. By contrast, comparison theories assume that a comparison or statement of identity underlies the metaphor. The interpretive processes envisioned by comparison theorists are continuous with normal processes;

they focus on the comparison operation or, to use Richards' terms, on finding the ground of the metaphor. Interaction theorists tend to have an elaborated view of what comparison entails. They tend to emphasize that only certain features of tenor and vehicle are involved and that these may rise or fall in salience. On the model we propose, comparison occurs only sometimes and then only after an elaborate process involving several other operations. These operations not only find the ground of the metaphor, but are often crucial in locating the tenor as well. As Sternberg (1977b, Note 9) argues, the operations involved are not peculiar to metaphor at all, but apply to analogies and literal statements of classification as well.

Some theorists focus on yet another aspect of the interpretive process. Reinhart (1976) has suggested that a process unique to metaphor involves interpreting the vehicle. Interpretation of the focus or vehicle consists of filling in or inferring implicit details of the vehicle from what information is given explicitly. The interpretive process for "riding the waves", for example, includes inferring not only "floating on the waves" (finding the tenor) but also "riding horses," the latter inference exemplifying vehicle or focus interpretation. On our view, metaphors can be seen as implicit analogies of the form "The tenor is to its domain what the vehicle is to its own." Nigro and Sternberg (Note 2) have proposed an explicit model based on the view that metaphors are often analogies with terms left out. They describe an experiment testing their model against data on the comprehension and appreciation of metaphors. In part, interpreting the metaphor involves inferring the missing terms. That the inference process involved is unique to metaphor has been denied by Verbrugge (1977), who regards the interpretive process required by metaphor to be just another example of the many inferential, reconstructive processes involved in

understanding language generally. Beardsley (1962), on the other hand, denies that vehicle interpretation occurs at all.

Evidence on Special Processes

If there are special processes for interpreting metaphors and these take appreciable amounts of time, then metaphors should on the average be interpreted more slowly than literal sentences. Even if the processes are not unique, but are just more complicated than usual, then metaphors should require more time to understand. Some of the anomaly theorists tend to assume that once the anomaly is recognized, special rules are invoked in interpreting metaphors. If these special rules have a role in performance (as well as in describing competence), then their application should take time. The most extreme views here are those that assume that the anomaly is only pragmatic, involving irrelevance in the context. Clark and Lucy (1975), for example, argue that nonliteral requests involve a similar pragmatic violation; these requests, they propose, are interpreted in two stages: the request receives a literal interpretation, an interpretation rejected for being irrelevant to the context; then a nonliteral interpretation is attempted. Clearly, the analogous two-stage model for interpreting metaphors requires metaphors to be understood more slowly than literal paraphrases (which require only the first stage). On the comparison and domains views of comprehension, the processes involved in metaphor are not unique but are more complicated than corresponding processes for literal sentences. Thus, on some comparison views, the derivational history of the surface form of the metaphor is more complex than that of similes. If this more complex history is reflected in a longer comprehension process (an assumption that is arguable), then metaphors should be slower to understand than similes. On the comprehension model we offer, the mapping operation involves aligning

different domains; it is thus qualitatively more difficult and hence slower than the mapping operation required by literal analogies and comparisons, which compare objects from a single domain.

Consistent with these several models, most researchers find that nonliteral sentences are interpreted more slowly: Ortony, Shallert, and Reynolds (Note 6), Clark and Lucy (1975), and Brewer, Harris, and Brewer (cited in Ortony, Reynolds, and Arter, Note 5) report slower comprehension times for nonliteral comparisons (Ortony et al., Note 6), indirect requests (Clark and Lucy, 1975) and figurative proverbs (Brewer et al.). Harris (1976), however, finds no differences between literal and metaphorical sentences. And Glucksberg, Hartman, and Stack (Note 10) find evidence that a plausible metaphorical interpretation interferes with verifying the literal sense of a sentence, suggesting that metaphorical interpretations are attempted automatically. These somewhat inconsistent results support several interpretations. As Glucksberg et al. suggest, we may not always wait to see whether literal interpretation fails before we attempt a metaphorical one. Strategic considerations and priming (cf. Ortony et al., Note 6) may affect performance in some cases: in an experiment where roughly half the sentences are metaphors, subjects may try to reverse the order of the normal processes or may be able to apply the special processes necessary with unusual speed. And, of course, some degree of parallel processing may occur. On the whole, however, the results so far tend to support the view that figurative language takes additional time to understand.

Conclusion

Although three general views on the nature of metaphor are current and although all three have strong implications for the central questions about metaphor (How are metaphors understood? What makes a good metaphor?), psychologists have gathered little evidence to settle the issues. On all three views, the similarity of the two terms linked by the metaphor--the tenor and vehicle--is critical both in the aptness of the metaphor and in the process of interpretation. On the anomaly view, the dissimilarity or distance between tenor and vehicle affects aptness, because dissimilarity relates to the novelty of the metaphor or because it relates to the difficulty of interpreting the metaphor. The dissimilarity of tenor and vehicle triggers the process of recognizing the anomaly that figures so prominently in anomaly theorists' accounts of the interpretive process. On the comparison view, similarity is central to aptness, because the similarity of tenor and vehicle determines how close the comparison is. As Aristotle observed, however, too much similarity makes for too obvious or literal a comparison. Discovering the comparison underlying the metaphor and the similarity that serves as its ground are, for the comparison theorist, the key to the comprehension process. Consistent with our domains-interaction view, we propose that the similarity of the concepts linked in the metaphor and the dissimilarity of their domains both contribute to aptness. Likewise, seeing one domain in terms of the other is central to the interpretive process. The scanty and somewhat inconsistent evidence to date suggests that (a) intermediate levels of similarity makes for the best metaphors, and (b) metaphors require more time to understand than literal sentences - a finding consistent with all three general views.

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Footnote

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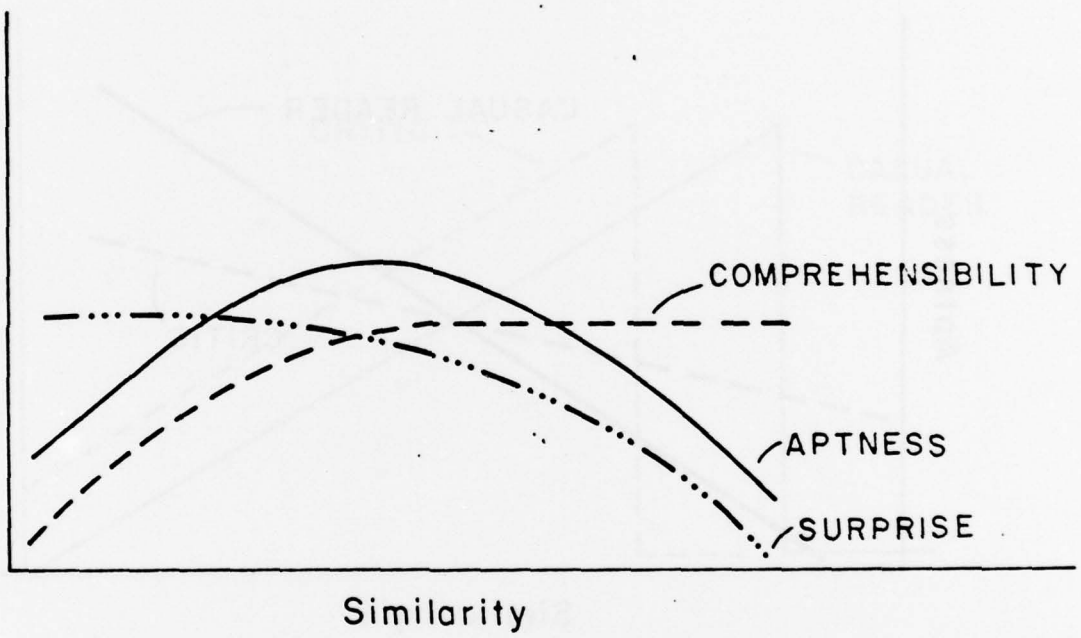
Figure Captions

Figure 1. Curvilinear relationship between aptness and similarity resulting from two opposed monotonic trends.

Figure 2. Theoretical linear relationship between similarity and aptness for critics and casual readers.

Figure 3. Cutoff model of the relationship between aptness and resemblance or similarity.

Figure 4. Theoretical curves for critic and casual reader under curvilinear hypothesis.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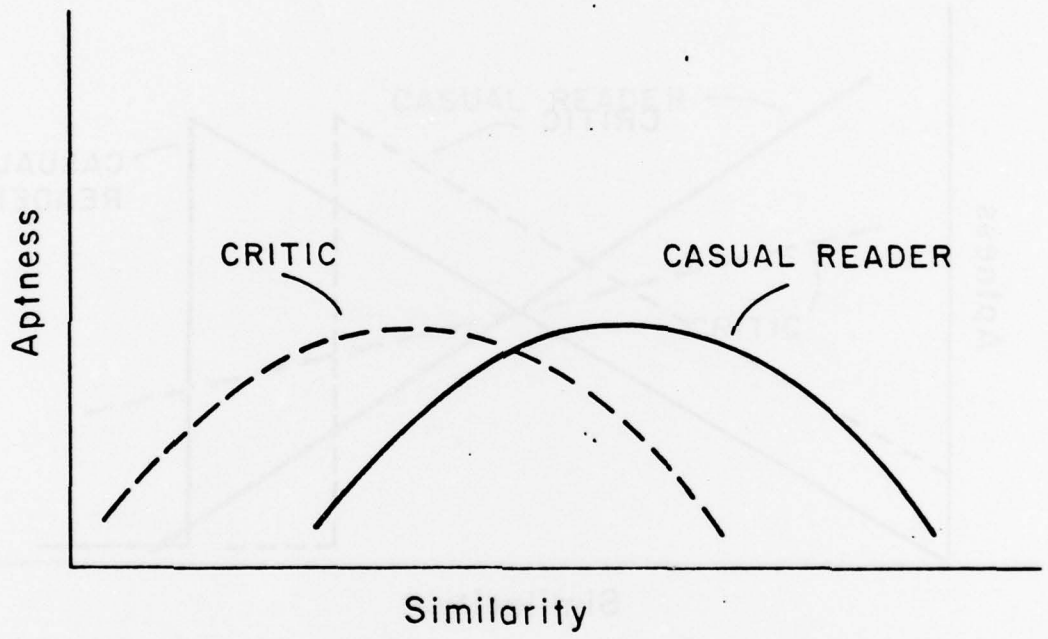
APTNESS
SURPRISE
Similarity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U.S. Civil Service Commission
1900 E Street NW
Washington, DC 20415

Dr. Andrew R. Molnar
Science Education Dev.
and Research
National Science Foundation
Washington, DC 20550

Dr. Thomas G. Sticht
Basic Skills Program
National Institute of Education
1200 19th Street NW
Washington, DC 20208

Dr. Joseph L. Young, Director
Memory & Cognitive Processes
National Science Foundation
Washington, DC 20550

Non Govt

1 PROF. EARL A. ALLUISI
DEPT. OF PSYCHOLOGY
CODE 287
OLD DOMINION UNIVERSITY
NORFOLK, VA 23508

1 DR. MICHAEL ATWOOD
SCIENCE APPLICATIONS INSTITUTE
40 DENVER TECH. CENTER WEST
7935 E. PRENTICE AVENUE
ENGLEWOOD, CO 80110

1 1 psychological research unit
Dept. of Defense (Army Office)
Campbell Park Offices
Canberra ACT 2600, Australia

1 MR. SAMUEL BALL
EDUCATIONAL TESTING SERVICE
PRINCETON, NJ 08540

1 Dr. Nicholas A. Bond
Dept. of Psychology
Sacramento State College
600 Jay Street
Sacramento, CA 95819

1 Dr. John Seeley Brown
Bolt Beranek & Newman, Inc.
50 Moulton Street
Cambridge, MA 02138

1 Dr. John B. Carroll
Psychometric Lab
Univ. of No. Carolina
Davie Hall 013A
Chapel Hill, NC 27514

1 Dr. William Chase
Department of Psychology
Carnegie Mellon University
Pittsburgh, PA 15213

1 Dr. Micheline Chi
Learning R & D Center
University of Pittsburgh
3939 O'Hara Street
Pittsburgh, PA 15213

Non Govt

Dr. Kenneth E. Clark
College of Arts & Sciences
University of Rochester
River Campus Station
Rochester, NY 14627

Dr. Norman Cliff
Dept. of Psychology
Univ. of So. California
University Park
Los Angeles, CA 90007

Dr. Allan M. Collins
Bolt Beranek & Newman, Inc.
50 Moulton Street
Cambridge, Ma 02138

Dr. Meredith Crawford
5605 Montgomery Street
Chevy Chase, MD 20015

Dr. Donald Dansereau
Dept. of Psychology
Texas Christian University
Fort Worth, TX 76129

DR. RENE V. DAVIS
DEPT. OF PSYCHOLOGY
UNIV. OF MINNESOTA
75 E. RIVER RD.
MINNEAPOLIS, MN 55455

Dr. Ruth Day
Center for Advanced Study
in Behavioral Sciences
202 Junipero Serra Blvd.
Stanford, CA 94305

ERIC Facility-Acquisitions
4833 Rugby Avenue
Bethesda, MD 20014

MAJOR I. N. EVONIC
CANADIAN FORCES PERS. APPLIED RESEARCH
1107 AVENUE ROAD
TORONTO, ONTARIO, CANADA

Non Govt

1 Dr. Richard L. Ferguson
The American College Testing Program
P.O. Box 168
Iowa City, IA 52240

1 Dr. Victor Fields
Dept. of Psychology
Montgomery College
Rockville, MD 20850

1 Dr. Edwin A. Fleishman
Advanced Research Resources Organ.
8555 Sixteenth Street
Silver Spring, MD 20910

1 Dr. John R. Frederiksen
Bolt Beranek & Newman
50 Moulton Street
Cambridge, MA 02138

1 DR. ROBERT GLASER
LRDC
UNIVERSITY OF PITTSBURGH
3939 O'HARA STREET
PITTSBURGH, PA 15213

1 DR. JAMES G. GREENO
LRDC
UNIVERSITY OF PITTSBURGH
3939 O'HARA STREET
PITTSBURGH, PA 15213

1 Dr. Ron Hambleton
School of Education
University of Massechusetts
Amherst, MA 01002

1 Dr. Barbara Hayes-Roth
The Rand Corporation
1700 Main Street
Santa Monica, CA 90406

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P.O. Box 293
Ft. Knox, KY 40121

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University of Washington
Seattle, WA 98105

Mr. Gary Irving
Data Sciences Division
Technology Services Corporation
2811 Wilshire Blvd.
Santa Monica CA 90403

Dr. Roger A. Kaufman
203 Dodd Hall
Florida State Univ.
Tallahassee, FL 32306

Dr. Steven W. Keele
Dept. of Psychology
University of Oregon
Eugene, OR 97403

Mr. Marlin Kroger
1117 Via Goleta
Palos Verdes Estates, CA 90274

LCOL. C.R.J. LAFLEUR
PERSONNEL APPLIED RESEARCH
NATIONAL DEFENSE HQS
101 COLONEL BY DRIVE
OTTAWA, CANADA K1A 0K2

Dr. Frederick M. Lord
Educational Testing Service
Princeton, NJ 08540

Dr. Robert R. Mackie
Human Factors Research, Inc.
6780 Cortona Drive
Santa Barbara Research Pk.
Goleta, CA 93017

Non Govt

1 Dr. Richard B. Millward
Dept. of Psychology
Hunter Lab.
Brown University
Providence, RI 82912

1 Dr. Donald A Norman
Dept. of Psychology C-009
Univ. of California, San Diego
La Jolla, CA 92093

1 Dr. Melvin R. Novick
Iowa Testing Programs
University of Iowa
Iowa City, IA 52242

1 Dr. Jesse Orlansky
Institute for Defense Analysis
400 Army Navy Drive
Arlington, VA 22202

1 Dr. Seymour A. Papert
Massachusetts Institute of Technology
Artificial Intelligence Lab
545 Technology Square
Cambridge, MA 02139

1 MR. LUIGI PETRULLO
2431 N. EDGEWOOD STREET
ARLINGTON, VA 22207

1 DR. PETER POLSON
DEPT. OF PSYCHOLOGY
UNIVERSITY OF COLORADO
BOULDER, CO 80302

1 Dr. Frank Pratzner
Cntr. for Vocational Education
Ohio State University
1960 Kenny Road
Columbus, OH 43210

1 DR. DIANE M. RAMSEY-KLEE
R-K RESEARCH & SYSTEM DESIGN
3947 RIDGEMONT DRIVE
MALIBU, CA 90265

Non Govt

MIN. RET. M. RAUCH
P II 4
BUNDESMINISTERIUM DER VERTEIDIGUNG
POSTFACH 161
53 BONN 1, GERMANY

Dr. Mark D. Reckase
Educational Psychology Dept.
University of Missouri-Columbia
12 Hill Hall
Columbia, MO 65201

Dr. Joseph W. Rigney
Univ. of So. California
Behavioral Technology Labs
3717 South Hope Street
Los Angeles, CA 90007

Dr. Andrew M. Rose
American Institutes for Research
1055 Thomas Jefferson St. NW
Washington, DC 20007

Dr. Leonard L. Rosenbaum, Chairman
Department of Psychology
Montgomery College
Rockville, MD 20850

Dr. Ernst Z. Rothkopf
Bell Laboratories
600 Mountain Avenue
Murray Hill, NJ 07974

PROF. FUMIKO SAMEJIMA
DEPT. OF PSYCHOLOGY
UNIVERSITY OF TENNESSEE
KNOXVILLE, TN 37916

DR. WALTER SCHNEIDER
DEPT. OF PSYCHOLOGY
UNIVERSITY OF ILLINOIS
CHAMPAIGN, IL 61820

DR. ROBERT J. SEIDEL
INSTRUCTIONAL TECHNOLOGY GROUP
HUMRRO
300 N. WASHINGTON ST.
ALEXANDRIA, VA 22314

Non Govt

1 Dr. Robert Singer, Director
Motor Learning Research Lab
Florida State University
212 Montgomery Gym
Tallahassee, FL 32306

1 Dr. Richard Snow
School of Education
Stanford University
Stanford, CA 94305

1 DR. ALBERT STEVENS
BOLT BERANEK & NEWMAN, INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

1 DR. PATRICK SUPPES
INSTITUTE FOR MATHEMATICAL STUDIES IN
THE SOCIAL SCIENCES
STANFORD UNIVERSITY
STANFORD, CA 94305

1 Dr. Kikumi Tatsuoka
Computer Based Education Research
Laboratory
252 Engineering Research Laboratory
University of Illinois
Urbana, IL 61801

1 DR. PERRY THORNDYKE
THE RAND CORPORATION
1700 MAIN STREET
SANTA MONICA, CA 90406

1 Dr. Benton J. Underwood
Dept. of Psychology
Northwestern University
Evanston, IL 60201

1 DR. THOMAS WALLSTEN
PSYCHOMETRIC LABORATORY
DAVIE HALL 013A
UNIVERSITY OF NORTH CAROLINA
CHAPEL HILL, NC 27514

1 Dr. Claire E. Weinstein
Educational Psychology Dept.
Univ. of Texas at Austin
Austin, TX 78712

Non Govt

Dr. David J. Weiss
N660 Elliott Hall
University of Minnesota
75 E. River Road
Minneapolis, MN 55455

DR. SUSAN E. WHITELY
PSYCHOLOGY DEPARTMENT
UNIVERSITY OF KANSAS
LAWRENCE, KANSAS 66044

Additions to Distribution List:

LT Steven D. Harris, MSC, USN
Naval Aerospace Medical Research Lab
NAS, Pensacola, FL 32508

Dr. Fred Reif
SESAME
University of California
Berkeley, CA 94720

Dr. Robert Breaux
Human Factors Lab
Naval Training Equipment Center
Code N-215
Orlando, FL 32813